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A review and checklist of the Neotropical Nepticulidae (Lepidoptera)

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CONTENTS

SYNOPSIS. Fieldwork in 2000–2001 has added substantially to our knowledge of the Nepticulidae of the upper Amazon basin and the Andes and increased the number of species known from the Neotropical Region from 58 to 74. Two species – *Manoneura basidactyla* (Davis) and *Ectoedemia fuscivittata* Puplesis & Robinson – are recorded from equatorial America for the first time here and are redescribed, with amplified descriptions and illustrations. A revised checklist of the Neotropical Nepticulidae is given together with an updated distribution map for Central and Southern America. *Fomoria latipennata* Puplesis & Robinson is transferred to *Acalyptris*, **comb. n.** Four new species-groups (*Stigmella tiliella-group*, *S. barbata-group*, *Fomoria molybditis-group* and *Acalyptris latipennata-group*) are defined. Hostplant data are reviewed and further hostplant genera from which mines or cocoons have been collected are noted. The diversity and distribution of the Neotropical Nepticulidae are discussed.

INTRODUCTION

Nepticulidae are a family of minute monotrysian Microlepidoptera with a worldwide distribution and about 750 described species. Their morphology, biology and taxonomic composition have been recently reviewed (Puplesis & Robinson, 2000).

The size of the adults, concealed mining life-style of the larvae (predominantly in leaves), and the difficulty of rearing imagines goes some way towards explaining why these moths are still poorly studied in many regions. Only the northern European nepticulid fauna can be considered to have been exhaustively studied. Studies in other regions of the world in all probability underestimate the diversity of the group. Key works are reviewed by Puplesis & Robinson (2000).

The history of description of Nepticulidae from the Neotropical Region has been reviewed by Puplesis & Robinson (2000). That paper, based on the results of fieldwork in Belize in 1998 by Puplesis and Simon Hill (UW) together with investigation of unidentified material in ZMUC and USNM, documented a total of seven genera and 58 species of Nepticulidae from Central and Southern America. Twenty-eight of those species recognized were new taxa from Belize (including four species left unnamed). None was from the "heart" of the Neotropics – the Amazon basin – and it was assumed that the absence of specimens from Amazonian rainforest reflected collecting effort, coupled with a lack of diversity.

In the preceding paper in this journal (Puplesis, Diškus & Robinson, 2002) sixteen new species from the upper Amazon basin and the Andes (Ecuador) are recorded, increasing the number of species known from the neotropics by more than one-fifth. The fieldwork in Ecuador upon which that paper is based resulted in the acquisition of additional material of *Manoneura basidactyla* (Davis) and *Ectoedemia fuscivittata* Puplesis & Robinson. These are the first records of these taxa from equatorial America. In this paper we amplify the descriptions and provide further illustrations of these species and update the checklist of Neotropical Nepticulidae with a distribution chart and map. We define four species-groups and review the known biologies of neotropical Nepticulidae, adding observations on nepticulid leaf-mines in Ecuador, and review the diversity of Nepticulidae in tropical America.

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MATERIAL AND METHODS

Brief details of collecting localities in Ecuador (Fig. 1) were given in the preceding paper (Puplesis, Diškus & Robinson, 2002 – *q.v.*). Primary sites were at the Yasuni Research Station, Jatun Sacha Biological Station and Misahualli (Figs 2–4).

Jatun Sacha and the nearby village of Misahualli (8 km NW of Jatun Sacha) are located on the south side and the northern side of the upper Rio Napo respectively, about 20 km east of the base of the Andes. The environment is transitional between the lower slopes of the Andes and Amazon lowland. The area is formed by steep hills crossed by seasonal streams. The soil is mostly a red clay oxisol. Annual precipitation is 3900 mm, fairly evenly distributed throughout the year, though the collecting periods (January 2000 and January 2001) tended to be relatively dry. Around half of Jatun Sacha Reserve is covered with original undisturbed forest, while the remainder is secondary growth; Misahualli (Fig. 4) is mostly surrounded by secondary forest and only about 10 to 15% can be considered as primary forest. The most common plants in the area are: *Adiantum cayennense* Klotzsch, *Asplenium auritum* Swartz, *Anthurium balslevii* Croat, *Bactris gasipaes* H.B.K., *Guzmania acuminata* L.B.Smith, *Becquerelia cymosa* Brongn, *Calathea attenuata* Kennedy, *Heliconia stricta* Huber, *Epidendrum coronatum* Ruiz & Pavón, *Maxillaria tarumanensis* Hoehne, *Schefflera diplodactyla* Harms and *Matelea rivularis* Woodson.

Yasuni Research Station is based at the Yasuni National Park and Biosphere Reserve, which together cover approximately 9820 square kilometres of mainly pristine Amazon lowland rain forest, rivers, lagoons and swamps (Figs 2, 3). The annual precipitation pattern is very similar to Jatun Sacha. The most common plants in the area are: *Alseis lugonis* (L.) Andersson, *Astrocaryum urostachys* Burret, *Guatteria glaberrima* (R.E.) Fr., *Trigynaea triplinervis* D.M. Johnson & N.A. Murray, *Nectandra crassiloba* Rohwer, *Euterpe precatoria* Mart., *Ceiba samauma* (Mart.) K. Schum, *Phragmotheca ecuadorensis* W.S. Alverson, *Duguetia spixiana* Mart., *Oxandra mediocris* Diels, *Aristolochia goudotti* Duch., *Mauritia flexuosa* L.F., *Ceiba pentandra* (L.) Gaertn., *Inga tessmannii* Harms and *Miconia grandifolia* Ule.

Collecting methods, techniques for genitalia preparation and protocols for description are outlined in the preceding paper (Puplesis, Diškus & Robinson, 2002 – *q.v.*). Black and white drawings cannot show the metallic lustre (especially of the lustrous *Manoneura* species) and the coloured iridescence characteristic of most Nepticulidae, and details of such colours have been incorporated into species descriptions.

Genitalia drawings were made by Puplesis using a camera lucida from permanent slides.

ABBREVIATIONS OF INSTITUTIONS

BMNH	The Natural History Museum, London, UK (formerly British Museum (Natural History))
VPU	Vilnius Pedagogical University, Vilnius, Lithuania
USNM	National Museum of Natural History, Washington DC, USA (formerly United States National Museum)
ZMUC	Zoologisk Museum, University of Copenhagen, Copenhagen, Denmark

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REDESCRIPTIONS OF *MANONEURA BASIDACTYLA* AND *ECTOEDEMIA FUSCIVITTATA*

Manoneura basidactyla (Davis, 1978)

(Figs 6, 9–15, 21)

Oligoneura basidactyla Davis, 1978: 218–219.
Manoneura basidactyla Davis: Puplesis & Robinson, 2000: 22,23, figs 12, 61, 83–85, 207.

MALE (Fig. 6). Forewing length: 1.7–2.1 mm (Central American specimens) and about 2.2 mm (Amazonian specimens). Wingspan: 4.3–4.9 mm. Head: palpi yellowish cream to ochreous cream or cream; frontal tuft orange; collar a large tuft of lamellar yellowish cream scales with golden reflection; eye-caps yellowish cream; antenna brownish grey, ca. 38–44 segments. Thorax, tegulae and forewing fuscous brown with bronze or copper (in Amazonian specimens) iridescence and very strong blue and purple reflections. Distinct postmedian fascia of forewing oblique, yellowish gold. Cilia fuscous, tending be lighter distally. Underside of forewing brown to dark brown (with purple and bluish iridescence in Amazonian specimens). Hindwing lanceolate, very slender, dark brown with strong purple and blue reflections which are stronger on upperside of hindwing; cilia brownish. No androconia on forewing or hindwing. Legs grey to fuscous but tarsi cream. Abdomen black on upperside, blackish grey on underside; genital segments blackish grey, not contrasting with main colour of abdomen.

FEMALE. Similar to male. Forewing length: 2.2–2.4 mm. Wingspan: 5.3–5.4 mm. Antenna ca. 32–38 segments. Legs cream with black lateral shading or mainly fuscous (in Amazonian specimens). Abdomen blackish on upperside but cream or creamy brown on underside. Otherwise as male.

GENITALIA ♂ (Figs 9–14). Capsule ca. 290–305 µm long. Tegumen with short caudally slightly bilobed pseuduncus-like extension. Uncus with strong pointed central process directed anteriorly, and long narrow lateral arms directed posteriorly. Gnathos with small but complex and well-sclerotized v-shaped central region and rather membranous broad lateral arms; shape and sclerotization of central element may vary. Natural position of central pointed process of uncus very closely appressed to posterior excavation of central part of gnathos (appearing to be a single structure) (Fig. 10). Valva ca. 205–215 µm long, relatively narrow in distal half and gradually broadened towards base; apical process long and slender. Transtilla absent, i.e., no transverse bar; bases of valvae with remarkably long and straight apodemes. Vinculum very long and very broad, truncate at anterior end; no anterior excavation or lateral lobes. Aedeagus 236–246 µm long, with two pairs of pointed lateral carinae; no cornuti on vesica. Juxta a band-like sclerite, abruptly broadened basally, fused with aedeagus.

GENITALIA ♀ (Fig. 15). Total length ca. 720–915 µm. Anal papillae undeveloped. S8 and T8 widely rounded. Apophyses posteriores short and complex. Apophyses anteriores very slender, 0.5–0.7 length of apophyses posteriores. Vestibulum sclerotized. Caudal part of corpus bursae very narrow; remaining part ovally broadened; no signa visible. Accessory sac undeveloped, in Central American specimens represented by a small but clearly visible ring-like sclerotization; ductus spermathecae always long and narrow, slightly sinuous.

BIOLOGY. Hostplant: *Coccoloba uvifera* (L.) L., Polygonaceae (for the Caribbean fauna; specimens from Amazon rainforest have not been reared and the hostplant is not established). Adults collected in January, April–May and July. The suggestion that the species might be univoltine (Davis, 1978) is not supported.

DIAGNOSIS. *M. basidactyla* may be distinguished from the other species of the genus (*trinaria*) by the relatively straight valva and distally truncate vincu-

lum; externally it is similar in pattern and iridescence, but *basidactyla* is slightly paler. It differs from other nepticulids from the Neotropical Region (except *Manonenra trinaria*) in the strong purple reflection of the forewing and the large distally truncate vinculum together with the very specialized shape of the gnathos (shared only with *trinaria*).

DISTRIBUTION (Fig. 21). Southwest coast of Florida, Dominica, Belize, Ecuador. It is likely that the species has a wide distribution in tropical forest in the Neotropics.

MATERIAL EXAMINED. **Belize**: Chiquibul Forest Reserve, Las Cuevas, 3♂, 2♀, 3–16.iv.1998 (*Puplesis & Hill*) genitalia slide no. 29120♂, no. 29121♀ (BMNH); 2♂, 1♀, same data, wing venation slide no. AD0314♀ (VPU). **Dominica**: Pont Casse, 1♂, 16.v.1965 (*Davis*) genitalia slide no. Diškus 002 (USNM); Cabrit Swam, 1♂, 1♀, 10–13.v.1965 (*Davis*) (USNM); Springfield Est., 2 specimen (no abdomens), 20–26.vii.1963 (*Flint*) (USNM). **Ecuador**: Napo Region, SE of Coca, near Rio Tiputini, Yasuni National Park, 260 m, 1 ♂, genitalia slide no. AD0327 VPU, 1♀, genitalia slide no. AD0326 VPU, 15–25.i.2000 (*Puplesis & Hill*).

Ectoedemia fuscivittata Puplesis & Robinson, 2000

(Figs 7, 8, 16–21)

Ectoedemia fuscivittata Puplesis & Robinson, 2000: 42, figs 39, 154–156, 223.

MALE (Figs 7, 8). Forewing length: 1.7–1.8 mm. Wingspan: 4.1–4.3 mm. Head: palpi cream to ochreous cream; frontal tuft pale ochreous to pale orange-ochreous; collar indistinct, pale ochreous, comprised of piliform scales; eyecaps ochreous cream, moderately large; antenna brownish or greyish to pale brownish ochreous, 42–44 segments. Thorax anteriorly ochreous yellow, elsewhere metallic grey; tegulae ochreous yellowish with few greyish scales anteriorly. Forewing basal three-fifths to fascia metallic grey to ochreous cream (Amazonian specimen) with or without (Amazonian specimen) distinctive blue-green and some indistinct purplish reflection; entire forewing of Amazonian specimen, or, in Belize specimens, narrow area along costa, particularly before fascia and on tornus, and area beyond fascia with ochreous cream scales; distinct postmedian fascia oblique, fuscous brown, but weakly defined in Amazonian specimen; with some dark brown scales in area before cilia. Cilia metallic greyish or dark ochreous cream in Amazonian specimen. Underside of forewing grey-brown or brown-ochreous. Hindwing pale brownish, cilia greyish to brownish grey; a long patch of whitish scales may be visible on basal half of hindwing upperside, however these androconia not always distinctive. Legs cream or ochreous, with or without (Amazonian specimen) grey-fuscous lateral shading. Abdomen fuscous brown on upperside, brown or brownish on underside; genital segments mostly covered by dark (predominantly brown) scales, not contrasting with main colour of abdomen.

FEMALE. Unknown.

GENITALIA ♂ (Figs 16–20). Capsule 268–270 µm long. Pseuduncus small, distinctly rounded and strongly papillated. Dorsal plate of tegumen simple, small. Gnathos with triangular caudal process, slender lateral arms, and small oval central plate. Valva 150–170 µm long, distinctly triangular, with more or less straight inner margin tapering into pointed, caudally directed apical process; in Amazonian specimen apical processes particularly narrow (Fig. 19). Basal margins of valva strongly sclerotized. Transtilla without transverse bar, but with rather long and slender or very slender valval apodemes. Juxta absent, valvae fused via basal membranous joint. Vinculum very small, with very small but distinctly shaped and well-sclerotized lateral lobes; in Amazonian specimen the lobes broader. Anterior excavation of vinculum always very shallow, broad or narrow (Amazonian specimen). Aedeagus 210–235 µm long, abruptly bulged in basal 1/2–2/3 or gradually broadened (Amazonian specimen); without carinae and weakly sclerotized apical part; vesica with some very tiny indistinct cornuti only; strong sclerotization of aedeagal tube in Amazon specimen may appear as a long spine-like cornutus but it is not such (genitalia slide no. AD0328 VPU, Fig. 20).

BIOLOGY. Adults collected in April (Belize) and January (Ecuador).

DIAGNOSIS. Although many species belonging to *Ectoedemia* are not easily distinguishable from each other, *fuscivittata* is an exception: the combination of features such as the caudally directed valval process, basally broadened aedeagus, very short vinculum, and dark oblique forewing fascia make this a very distinctive species. The absence of a transverse transtilla bar in this species sets it apart from all other *Ectoedemia*.

DISTRIBUTION (Fig. 21). Rainforest in Belize and Ecuador.

MATERIAL EXAMINED. **Belize**: Cayo District, Chiquibul Forest Reserve, Las Cuevas, 3♂ [holotype (BMNH) and paratypes (BMNH, VPU)] 3–16.iv.1998 (*Puplesis & Hill*) genitalia slides no. 29107 [holotype], no. AD 0302 [paratype, VPU]. **Ecuador**: Napo Region, SE of Coca, near Rio Tiputini, Yasuni National Park, 260 m, 1 ♂, genitalia slide no. AD0328 VPU, 15–25.i.2000 (*Puplesis & Hill*).

REVISED CHECKLIST OF NEOTROPICAL NEPTICULIDAE

Seventy-four species are now recognized from the Neotropical Region (including most of Mexico, together with the US states of Arizona and Florida) and these are listed in Table 1. Another eight species with a distribution range from the north of Florida into the northern states of the USA should not be considered to be part of the neotropical fauna; *Stigmella nigriverticella* (Chambers), *S. castaneaefoliella* (Chambers), *S. ostryaefoliella* (Clemens), *S. myricafoliella* (Busk), *Ectoedemia clemensella* (Chambers), *E. similella* (Braun), *E. virgulae* (Braun), *E. obrutella* (Zeller) have predominantly boreal distribution ranges and/or hostplants.

DISCUSSION

Definition of species-groups, taxonomic notes

Venation. In studying neotropical Nepticulidae we have met difficulties in using wing venation to clarify the generic position of species. Although wing venation can provide useful characters for generic diagnosis of many Holarctic or South African Nepticulidae (Scoble, 1983; Nieukerken, 1986; Puplesis, 1994), a few Neotropical species show unusually strong reduction of the venation, limiting the wider value of venational features. This is notable in some *Fomoria* such as *F. diskusi* (Puplesis & Robinson, 2000: fig. 64). On the other hand, a few other neotropical species have a less derived venation than Old World members of the same genus. In the forewing of *Euteuchia guajavae, Stigmella ovata* and *Acalyptris onorei* R4 and R5 are represented by two separate veins and are not coalescent as is usual in these genera (see Puplesis & Robinson, 2000: fig. 62; Puplesis, Diškus & Robinson, 2002: figs 1, 2). The accepted generic diagnoses of these groups are based upon the Old World taxa and need revision in the light of the morphology of the neotropical representatives.

Stigmella salicis-group. This long-established group contains more than 30 described species worldwide. It was first designated for European species and currently contains 15 described Palaearctic representatives. However, it also has at least two representatives in the Nearctic (known as the '*fuscotibiella*-group'). Puplesis & Robinson (2000) recognized 14 mostly Andean species as belonging here. All Holarctic species (except one on *Vaccinium*) feed on Salicaceae (*Salix, Populus*) while Neotropical taxa feed on Rosaceae (*Rubus*) and Euphorbiaceae (*Acalypha*). The female genitalia of most of the Neotropical species lack the characteristic signum of tiny, dentate chitin plates encircling the bursa that is a derived feature and typical of the Holarctic members of the group; just *olyritis* and *montanotropica* (see Puplesis, Diškus & Robinson, 2002: Fig. 91) have a similar structure on the bursa. The male genitalia of the Neotropical species are similar to those of Holarctic *salicis*-group species. The Holarctic representatives may form a monophyletic entity within the *salicis*-group, defined by the presence of a signum, and derived from a Neotropical-type ancestor.

Stigmella tiliella-group. A new species-group is designated here for two closely related and distinctive species. A rounded valva with a short dorsal process, broadly U-shaped gnathos and a cluster (or clusters) of spine-like cornuti in the aedeagus are characteristic of the male genitalia. The group resembles the Holarctic *paradoxa*-group but differs in the cornuti clusters and gallery mines (which in the *paradoxa*-group are combined, i.e., distinctly blotch-shaped in the second half of the course). The group contains *Stigmella tiliella* (Braun) known from the Nearctic (USA, Kentucky) and *S. kiuae* Puplesis & Robinson, 2000 (Belize). The first makes gallery-type mines on *Tilia americana* leaves; the hostplant of the second species is still unknown.

Stigmella barbata-group. The group is newly designated here for species possessing unique plumose scales on the apex (or apical third) of the valva; in contrast to most *Stigmella*, the complement of cornuti in the aedeagus is very weakly developed, the cornuti tiny and weakly sclerotized. The group appears to be endemic to the Neotropics and contains three species: *Stigmella plumosetaeella* Newton & Wilkinson, 1982, *barbata* Puplesis & Robinson, 2000 and *austroamericana* Puplesis & Diškus, 2002; the biology of these species is unknown. The recently discovered Amazonian *austroamericana* appears to be the sister-group of the Central American *barbata* and the two appear to represent an allopatric and vicariant species-pair.

Fomoria. Although some species of *Fomoria* may be clearly grouped as monophyletic units, the taxonomic status of the genus itself is questionable because its monophyly is unproven. The genitalia of *Fomoria* and *Ectoedemia* (sensu stricto) follow the same ground plan, but the uncus (which is entirely reduced in *Ectoedemia*) is fully preserved in *Fomoria* (a plesiomorphy). Vein Cu in the forewing tends to be shortened or completely lacking (apomorphy) in *Fomoria*, but this character is not always consistent, at least among the Neotropical representatives (see above: *Venation*).

Table 1. Distribution of Neotropical Nepticulidae. The USA column includes only species from Arizona and Florida which are recognized as tropical; 'boreal' species with northern distribution ranges and/or temperate hostplants are excluded.

No	Species	USA	Mexico	Belize	Dominica	Guyana	Venezuela	Colombia	Ecuador	Peru	Argentina	Chile
	***ENTEUCHA* Meyrick, 1915**	•		•		•			•	•		
1	*cyanochlora* Meyrick, 1915					•						
2	*gilvafascia* (Davis, 1978)	•										
3	*hilli* Puplesis & Robinson, 2000			•								
4	*contracolorea* Puplesis & Robinson, 2000			•								
5	*terricula* Puplesis & Robinson, 2000									•		
6	*snaddoni* Puplesis & Robinson, 2000			•								
7	*guajavae* Puplesis & Diškus, 2002								•			
8	*acuta* Puplesis & Diškus, 2002								•			
	***MANONEURA* Davis, 1979**	•		•	•		•		•			
9	*basidactyla* (Davis, 1978)	•		•	•				•			
10	*triuaria* Puplesis & Robinson, 2000						•					
	***STIGMELLA* Schrank, 1802**	•	•	•		•		•	•	•	•	•
	The *salicis* species-group							•	•	•	•	•
11	*andina* (Meyrick, 1915)									•		
12	*cuprata* (Meyrick, 1915)									•		
13	*johannis* (Zellller, 1877)							•				
14	*rudis* Puplesis & Robinson, 2000										•	•
15	*marmorea* Puplesis & Robinson, 2000									•		
16	*peruanica* Puplesis & Robinson, 2000									•		
17	*epicosma* (Meyrick, 1915)									•		
18	*schoorli* Puplesis & Robinson, 2000									•		
19	*hamata* Puplesis & Robinson, 2000									•		
20	*imperatoria* Puplesis & Robinson, 2000									•		
21	*olyritis* (Meyrick, 1915)									•		
22	*montanotropica* Puplesis & Diškus, 2002								•			
23	*nubimontana* Puplesis & Diškus, 2002								•			
24	*rubeta* Puplesis & Diškus, 2002								•			
	The *eurydesma* species-group			•		•						
25	*eurydesma* (Meyrick, 1915)					•						
26	*albilamina* Puplesis & Robinson, 2000			•								
27	*fuscilamina* Puplesis & Robinson, 2000			•								
	The *tiliella* species-group			•								
28	*kimae* Puplesis & Robinson, 2000			•								
	The *barbata* species-group	•	•	•					•			
29	*plumosetaeella* Newton & Wilkinson, 1982	•	•									
30	*barbata* Puplesis & Robinson, 2000			•								
31	*austroamericana* Puplesis & Diškus, 2002								•			
	Unattributed to a species-group	•		•							•	
32	*gossypii* (Forbes & Leonard, 1930)	•										
33	*pruinosa* Puplesis & Robinson, 2000			•								
34	*ovata* Puplesis & Robinson, 2000										•	
35	*hylomaga* (Meyrick, 1931)										•	
36	*costalimai* (Bourquin, 1962)										•	
37	*guittonae* (Bourquin, 1962)										•	

Table 1 continued

No	Species	USA	Mexico	Belize	Dominica	Guyana	Venezuela	Colombia	Ecuador	Peru	Argentina	Chile
	***ECTOEDEMIA* Busck, 1907**	•		•					•			
38	*reneella* Wilkinson, 1981	•										
39	*helenella* Wilkinson, 1981	•										
40	*mesoloba* Davis, 1978	•										
41	*species 29105*			•								
42	*fuscivittata* Puplesis & Robinson, 2000			•					•			
	***FOMORIA* Beirne, 1945**			•				•	•			
43	*tabulosa* Puplesis & Diškus, 2002								•			
	The *molybditis* species-group			•				•	•			
44	*molybditis* (Zeller, 1877)							•				
45	*diskusi* Puplesis & Robinson, 2000			•								
46	*species 29122*			•								
47	*repanda* Puplesis & Diškus, 2002								•			
	***ACALYPTRIS* Meyrick, 1921**	•		•					•			
	The *latipennata* species-group			•					•			
48	*latipennata* (Puplesis & Robinson, 2000) **comb.n.**			•								
49	*dividua* Puplesis & Robinson, 2000			•								
50	*ecuadoriana* Puplesis & Diškus, 2002								•			
51	*onorei* Puplesis & Diškus, 2002								•			
	Unattributed to a species-group											
52	*bovicorneus* Puplesis & Robinson, 2000			•								
53	*martinlheringi* Puplesis & Robinson, 2000			•								
54	*fortis* Puplesis & Robinson, 2000			•								
55	*luspidus* Puplesis & Robinson, 2000			•								
56	*novenarius* Puplesis & Robinson, 2000			•								
57	*lascuevella* Puplesis & Robinson, 2000			•								
58	*bifidus* Puplesis & Robinson, 2000			•								
59	*trifidus* Puplesis & Robinson, 2000			•								
60	*tenuijuxtus* (Davis, 1978)	•										
61	*unicornis* Puplesis & Robinson, 2000			•								
62	*laxibasis* Puplesis & Robinson, 2000			•								
63	*bicornutus* (Davis, 1978)	•										
64	*species 29135*			•								
65	*platygnathos* Puplesis & Robinson, 2000			•								
66	*species 29140*			•								
67	*basihastatus* Puplesis & Diškus, 2002								•			
68	*pseudohastatus* Puplesis & Diškus, 2002								•			
69	*articulosus* Puplesis & Diškus, 2002								•			
70	*rotundus* Puplesis & Diškus, 2002								•			
71	*amazonius* Puplesis & Diškus, 2002								•			
72	*insolentis* Puplesis & Diškus, 2002								•			
	***GLAUCOLEPIS* Braun, 1917**			•						•		
73	*aerifica* (Meyrick, 1915)									•		
74	*argentosa* Puplesis & Robinson, 2000			•								

Fomoria molybditis-group. The group is newly designated here for species characterized by the outstandingly long transverse bar of the transtilla (apomorphy), broad and very long vinculum, and bilobed valva (often possessing large spine-like processes from the inner side). This distinctive group appears to be endemic to the Neotropics and contains four species: *molybditis* (Zeller, 1877), *diskusi* Puplesis & Robinson, 2000, *species 29122*, *repanda* Puplesis & Diškus, 2002. The biology of these species remains unknown.

Acalyptris latipennata-group. The group is newly designated here for species characterized by a distinctly broadened (or moderately broad) forewing with a dark oblique fascia, a distinctive paired uncus, and the presence of three very large cornuti at the apex of the aedeagus which tends to be slightly or strongly swollen; the valva of species of this group has an inner spine-like process (or papilla-like extension). This distinctive group appears to be endemic to the Neotropics and contains four species: *latipennata* (Puplesis & Robinson, 2000) (comb.n. – see below), *dividua* Puplesis & Robinson, 2000; *ecuadoriana* Puplesis & Diškus, 2002 and *onorei* Puplesis & Diškus, 2002; the biology of these species is unknown.

Acalyptris latipennata (Puplesis & Robinson) comb.n. Originally this strange-looking species was described as a *Fomoria* (Puplesis & Robinson, 2000). However, the later discovery of related species from Amazonian rainforest (i.e., *ecuadoriana* and *onorei*) indicates, from venational and other characters, that this species is correctly placed in *Acalyptris*, to which genus it is here transferred.

Leaf-mine collecting and hostplant data in equatorial America

There has been little elucidation of nepticulid biology in the Neotropics (Puplesis & Robinson, 2000). Our experience of mine collecting in equatorial America suggests that there are great differences between habitats with respect to diversity and abundance of mines. In lowland Amazon rainforest (such as Yasuni, 260 m) nepticulid mines are extremely difficult to find, and we have never observed mines in abundance although adults were readily attracted to light. In disturbed, mainly secondary premontane rainforest (Misahualli, 500 m) mining larvae were much more diverse and abundant. In progressing from the foothills of the Andes (Tandapi, 1200 m, Baños, 1500–2500) to the high Andes (Papallacta, 3500 m, and the slopes of Vol. Chimborazo, 4200 m) nepticulid mines became more abundant, but the diversity of species dropped significantly above 3000 m.

Hostplants from only eight plant genera belonging to eight families are known for identified species of Nepticulidae from the Neotropical region (Table 2). Records from *Ludwigia* and *Senecio* (Argentina) come from a paper by Bourquin (1962) and have not been confirmed by other authors.

We have obtained some additional data from fieldwork in Ecuador, but as rearings produced only single female adults or cocoons, these host records remain of 'unidentified Nepticulidae':

Rosaceae: *Lachemilla:* bloch-like mines, cocoons cream-white, on southern slopes of Vol. Chimborazo (4100–4200 m) (no. 4733-VPU); *Acaena*: short contorted galleries, on southern slopes of Vol. Chimborazo (4100–4200 m) (no. 4734-VPU); *unidentified plant genus*: blotch-like mines, cocoons yellowish, southern slopes of Vol. Chimborazo (3500–4000 m) (no. 4737-VPU).

Rubiaceae: *Psychotria:* sinuous or contorted gallery mines, Misahualli, 17 km SE of Tena, Amazon rainforest, 450–500 m (no. 4723, 4743-VPU).

Fabaceae: *Erythrina edulis* Triana ex Micheli. Balu: slender sinuous galleries, ochreous cocoons, western foothills of Andes, Bucay, ca. 700 m, (*Acalyptris* sp., 1 female reared-VPU) (no. 4736-VPU); *Inga*: long sinuous leaf-mines (Misahualli 17 km SE of Tena, Amazon rainforest, 450–500 m) are likely to be also Nepticulidae (No 4746-VPU).

Mines on *Bauhinia tarapotensis* Benth. (Fabaceae) (Amazon rainforest, no. 4630C -VPU) and *Cavendishia bracteata* (Ruiz & Pav. ex J.St. – Hil) Hoerold (Ericaceae) (Andes, Baños, ca. 1500 m) (no. 4721 - VPU) cannot be confirmed as of Nepticulidae and may have been produced by representatives of other Lepidoptera families.

Diversity and geography

Dominance of Acalyptris. One of the most unexpected results of investigations of the tropical American Nepticulidae was the discovery of a diverse fauna of *Acalyptris*. During the Belize expedition in 1998, a total of 14 species was found, representing 48% of Nepticulidae recorded from the area. We thought (Puplesis & Robinson, 2000) that the dominance of *Acalyptris* might be a regional (Central American) or a seasonal phenomenon. But sampling in Ecuador (mainly in rainforest) has shown a similar pattern exists there and at a different time of the year. A total of eight species of *Acalyptris* was found, representing 50% of Nepticulidae recorded from the area. Neotropical *Acalyptris* exhibit a remarkable range of morphological structure.

Table 2. Hostplants of Neotropical Nepticulidae.

Plant family	Plant genus	Nepticulidae reared	Remarks/Source
Polygonaceae	*Coccoloba*	*Enteucha gilvafascia, Manoneura basidactyla*	Davis, 1978
Malvaceae	*Gossypium*	*Stigmella gossypii*	Forbes & Leonard, 1930 and Davis, 1978
Euphorbiaceae	*Acalypha*	*Stigmella montanotropica*	
Rosaceae	*Rubus*	*Stigmella nubimontana, S. rubeta*	
Myrtaceae	*Psidium*	*Enteucha guajavae*	Cultivated host
Onagraceae	*Ludwigia*	*Stigmella guittonae*	Bourquin, 1962
Fabaceae	*Lonchocarpus*	*Acalyptris species 29140*	
Asteraceae	*Senecio*	*Stigmella guittonae*	Bourquin, 1962

Endemism of the fauna. The 74 species so far known from the Neotropical region all appear to be endemic at species or even species-group level. However, only a single genus – *Manoneura* – seems to be endemic to the region. Material from the southern part of the continent that has been recently studied superficially by the authors may contain one or two additional genera.

Potential diversity. Sampling of nepticulids in the Neotropical Region has been sparse, despite the vast potential of their habitat, and what we have seen so far is probably just a small fraction of the total. The Belize sample (January 1998: 29 species) and Ecuador sample (January 2000: 17 species) are geographically separated by some 2500 km and contain only two species in common, *Manoneura basidactyla* and *Ectoedemia fuscivittata*. The two Amazon rainforest samples separated by only 140 km (Yasuni, January 2000: 6 species; Jatun Sacha, January 2000: 7 species) have only a single species in common – *Acalyptris insolentis*. Sampling methods and weather conditions were similar at both sites. In the light of this, we would expect further collection and study to expand the known diversity of Nepticulidae in the Neotropical Region to at least 500 species.

Species numbers by country. The number of species known from each neotropical country (Table 1; Fig. 22) currently indicates only collecting and study activity. Only Belize and Ecuador have a species count greater than 15. Despite the suggested high diversity of Nepticulids in the Neotropics, species counts for individual countries are comparable only with the most poorly studied countries of other regions. They are not comparable with the known species diversity of European countries, the product of about 235 years of investigative history that began with the description of *Ectoedemia occultella* by Linnaeus in 1767 (Fig. 23).

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Fig. 1. Map of Ecuador showing collecting localities of 2000 and 2001 fieldwork programmes.

Figs 2–3. Ecuador collecting sites – Yasuni (240 m): 2, view over canopy (photo: Simon Hill); 3, along the Tiputini river.

Figs 4–5. Ecuador collecting sites: 4, Misahuallı (450 m), premontane tropical forest; 5, Tandapi, western slopes of the Andes, montane tropical forest.

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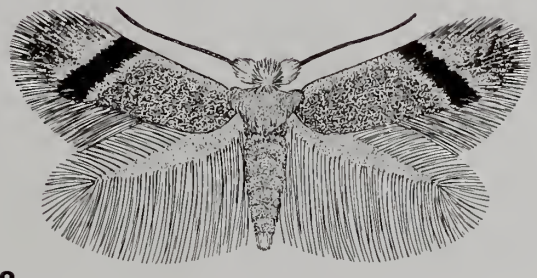

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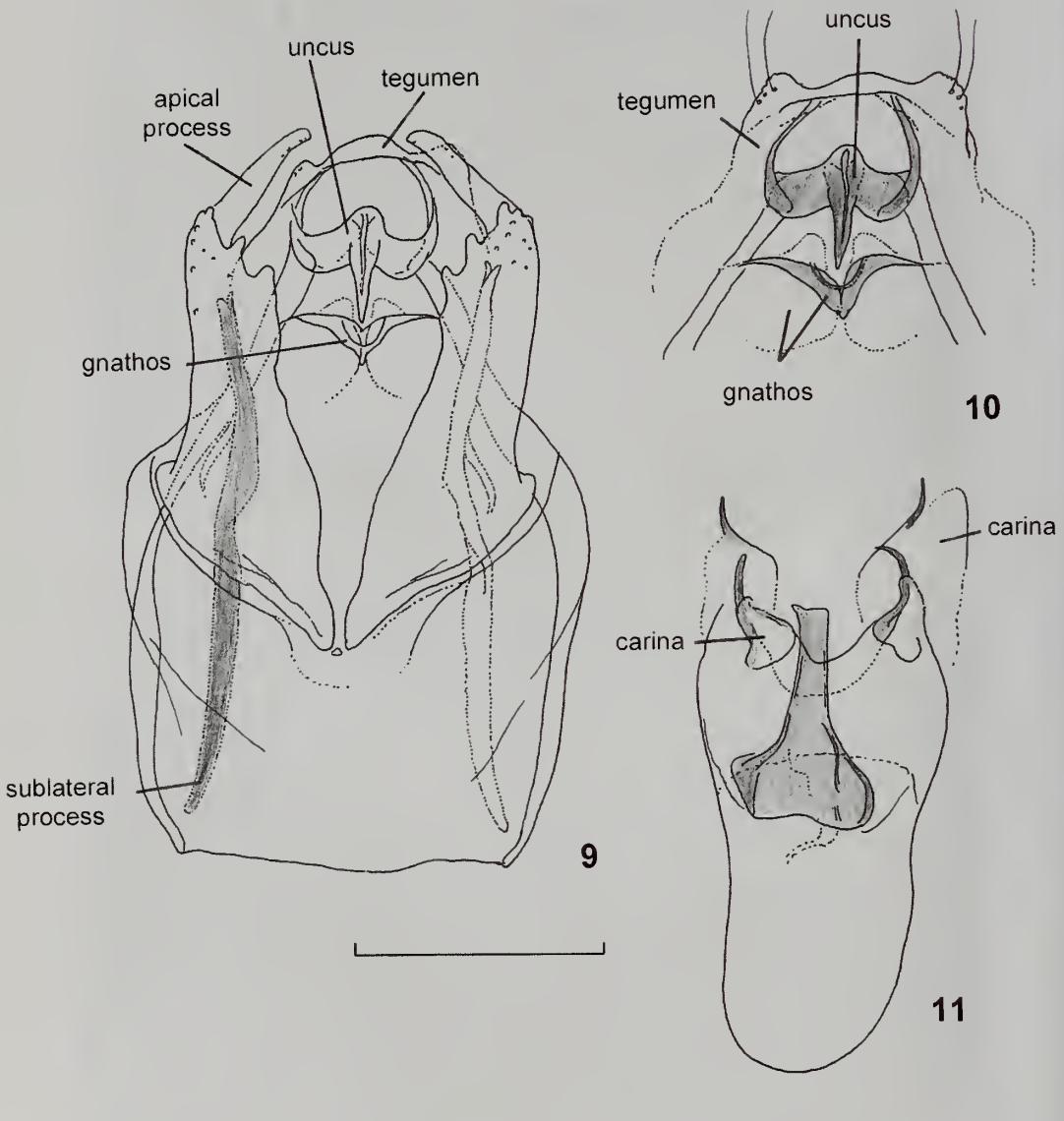
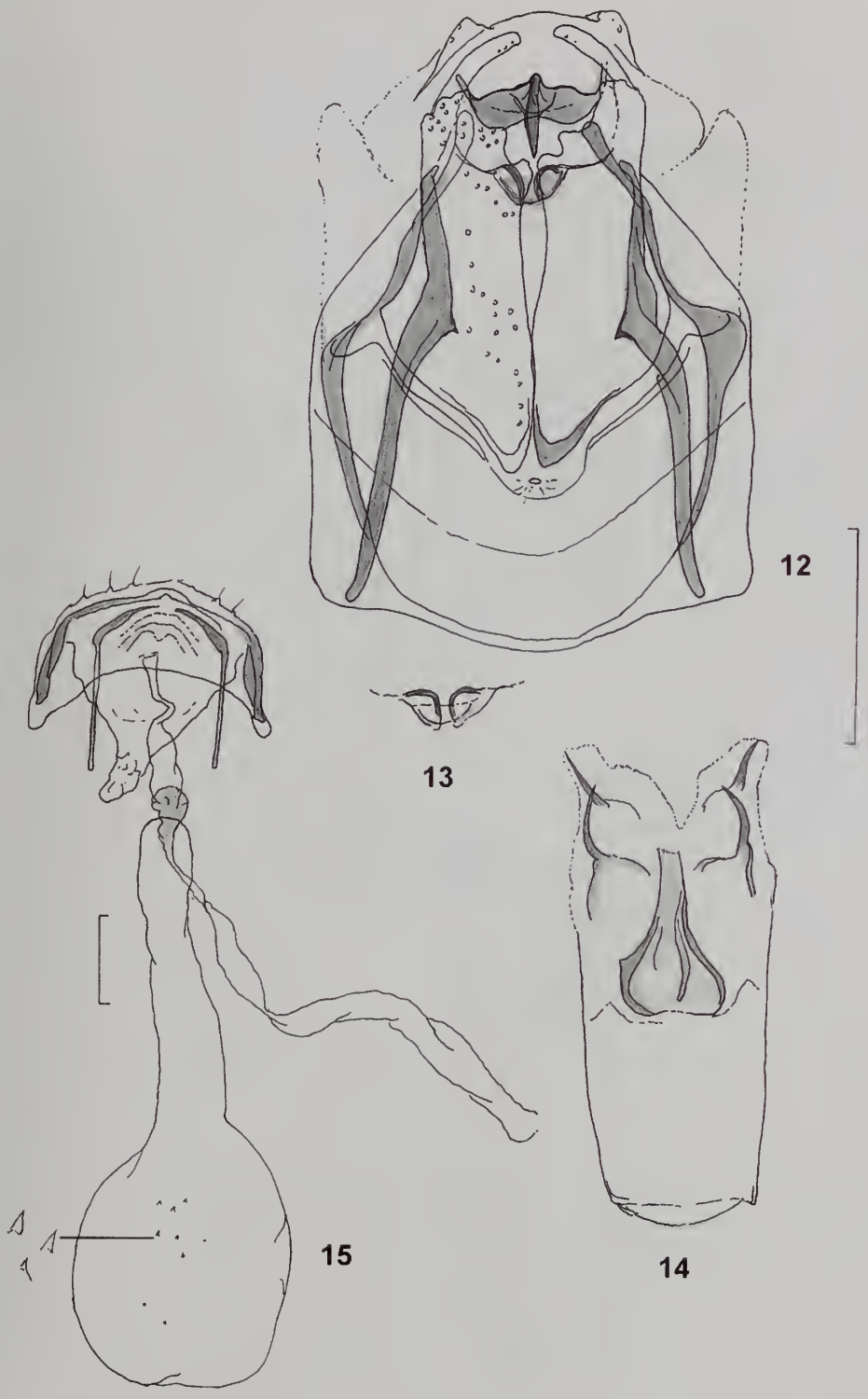
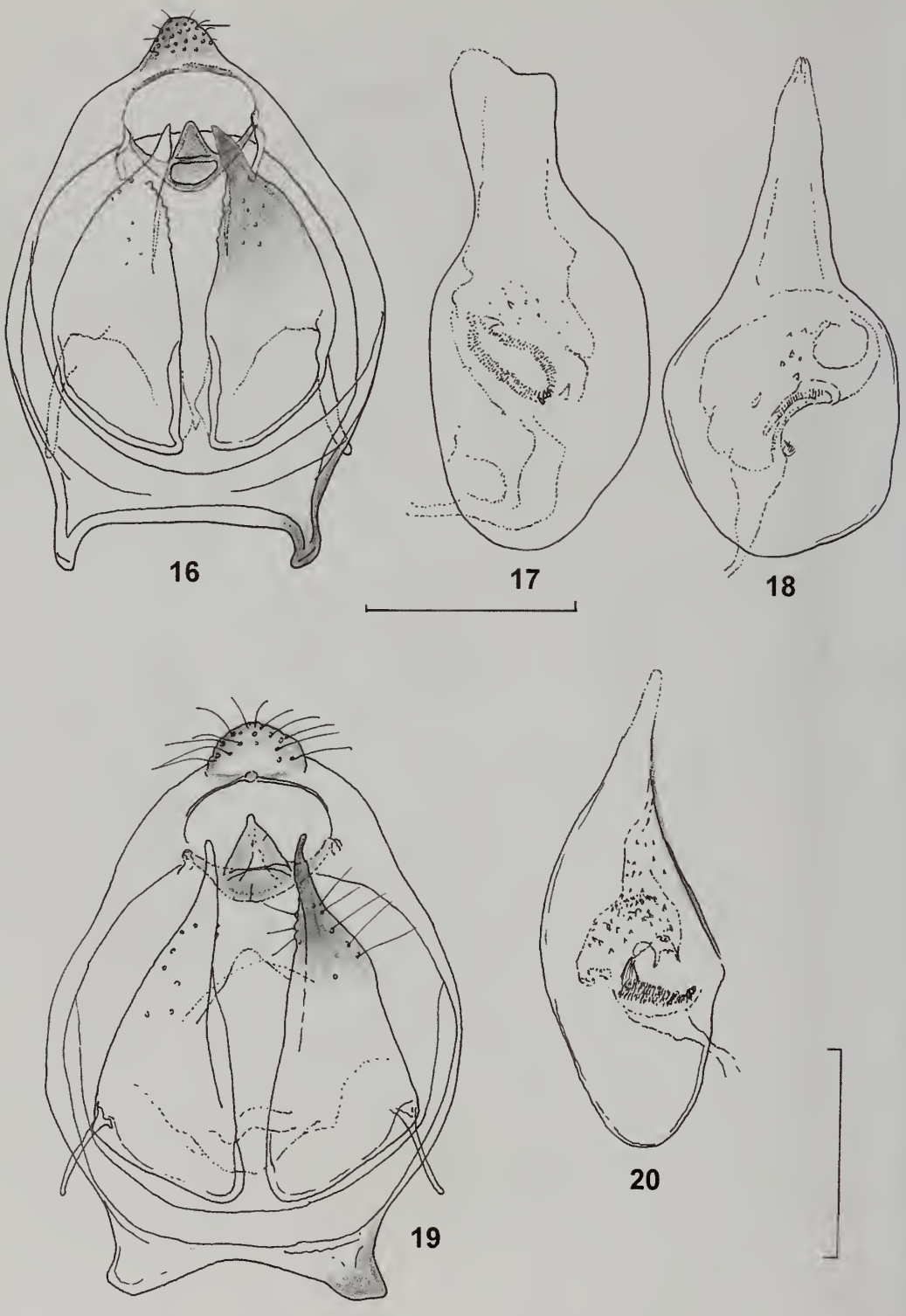
Figs 6–8. Adult Nepticulidae. 6, *Manoneura basidactyla*, Ecuador; 7, *Ectoedemia fuscivittata*, Ecuador; 8, *Ectoedemia fuscivittata*, Belize (type locality).



Figs 9–11. Male genitalia of *Manoneura basidactyla*, Belize (29120-BMNH): 9, capsule; 10, gnathos, uncus and tegumen; 11, aedeagus. Scale: 0.1 mm.



Figs 12–15. Genitalia of *Manoneura basidactyla*, Ecuador: 12, male genitalia, capsule (AD0327-VPU); 13, same, gnathos; 14, same, aedeagus; 15, female genitalia (AD0326-VPU). Scale: 0.1 mm.



Figs 16–20. Male genitalia of *Ectoedemia fuscivittata*: 16, holotype, Belize (29107-BMNH), capsule; 17, same, aedeagus; 18, same, paratype (AD0302-VPU); 19, Ecuador (AD0328-VPU), capsule; 20, same, aedeagus. Scale: 0.1 mm.

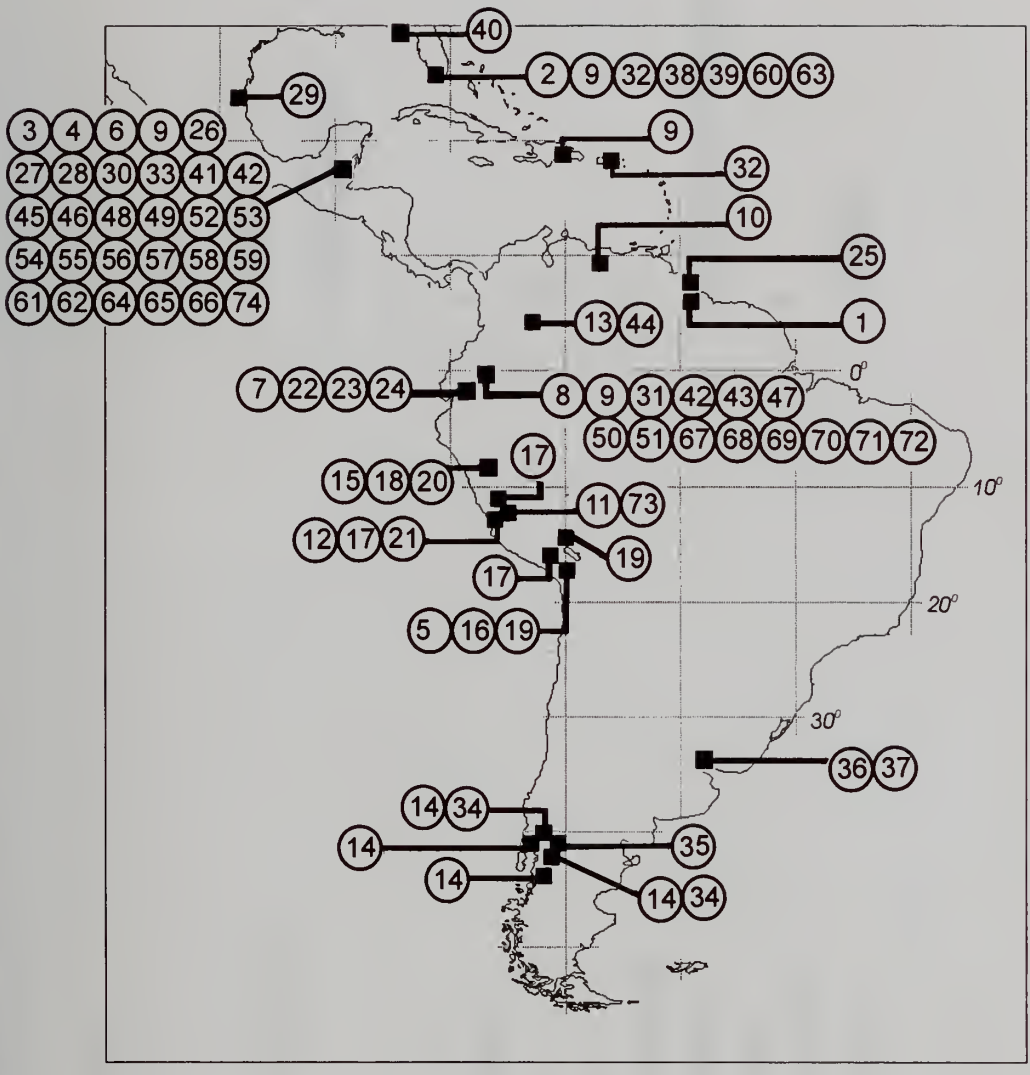


Fig. 21. Distribution map of Nepticulidae species recorded from the Neotropical Region: 1, *Enteucha cyanoclilora*; 2, *E. gilvafascia*; 3, *E. killi*; 4, *E. contracolorea*; 5, *E. terricula*; 6, *E. snaddoni*; 7, *E. guajavae*; 8, *E. acuta*; 9, *Manoneura basidactyla*; 10, *M. trinaria*; 11, *Stigmella andina*; 12, *S. cuprata*; 13, *S. johannis*; 14, *S. rudis*; 15, *S. marmorea*; 16, *S. peruanica*; 17, *S. epicosma*; 18, *S. schoorli*; 19, *S. hamata*; 20, *S. imperatoria*; 21, *S. olyritis*; 22, *S. montanotropica*; 23, *S. nubimontana*; 24, *S. rubeta*; 25, *S. eurydesma*; 26, *S. albilamina*; 27, *S. fuscilamina*; 28, *S. kimae*; 29, *S. plumosetaeella*; 30, *S. barbata*; 31, *S. austroamericana*; 32, *S. gossypii*; 33, *S. pruinosa*; 34, *S. ovata*; 35, *S. hylomaga*; 36, *S. costalimai*; 37, *S. guittonae*; 38, *Ectoedemia reneella*; 39, *E. helenella*; 40, *E. mesoloba*; 41, *E. species 29105*; 42, *E. fuscivittata*; 43, *Fomoria tabulosa*; 44, *F. molybditis*; 45, *F. diskusi*; 46, *F. species 29122*; 47, *F. repanda*; 48, *Acalyptris latipennata*; 49, *A. dividua*; 50, *A. ecuadoriana*; 51, *A. onorei*; 52, *A. bovicorneus*; 53, *A. martinlueringi*; 54, *A. fortis*; 55, *A. luispidus*; 56, *A. novenarius*; 57, *A. lascuevella*; 58, *A. bifidus*; 59, *A. trifidus*; 60, *A. tenuijuxtus*; 61, *A. unicornis*; 62, *A. laxibasis*; 63, *A. bicornutus*; 64, *A. species 29135*; 65, *A. platygnathos*; 66, *A. species 29140*; 67, *A. basihastatus*; 68, *A. pseudohastatus*; 69, *A. articulosus*; 70, *A. rotundus*; 71, *A. amazonius*; 72, *A. insolentis*; 73, *Glaucolepis aerifica*; 74, *G. argentosa*.

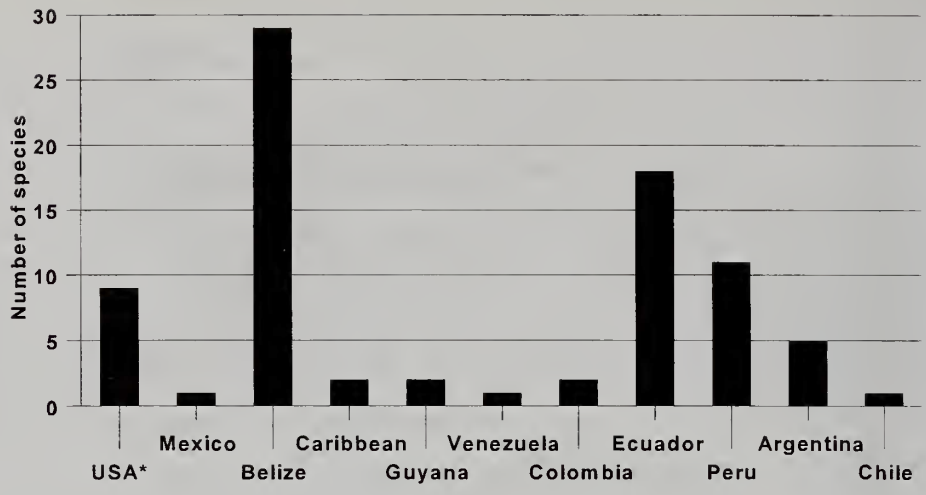


Fig. 22. Numbers of Nepticulidae recorded from the Neotropics. *The figure for the USA includes only species from Arizona and Florida recognized as tropical, and excludes boreal species.

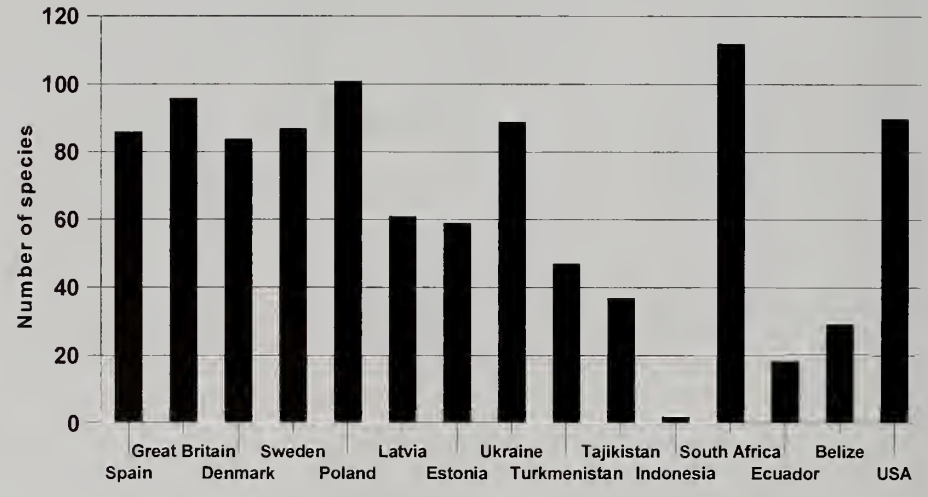


Fig. 23. Numbers of species of Nepticulidae recorded from various countries.